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## PIC16F84A Firmware Configuration Details: 400MHZ LCD Frequency Counter

### Configuration Details for FD-FC2A Firmware by using 4 Push Buttons and DIP slide switches and 3pin Header: S4, for add/sub function:

This Firmware version for 16F84A is based on the **OM3CPH's** LCD4DIGI.asm version on his website.

**User's parameter may now be set using PIC's EEPROM memory and save functions. This Software is designed for 4 MHz Crystal.**

As this version has 4-bit data bus between PIC and LCD unit, the remaining four I/O-pins are used for counter control.

**Following two modes available:**

- 1. COUNTER MODE and**
- 2. EEPROM MODE.**

**The RB0...RB3 have different functions in both modes:**

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### COUNTER MODE

False (0) True (1)

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RB0 COUNTER MODE EEPROM MODE \*)

RB1 RF offset1 RF offset2

RB2 Offset 1 & 2 Direct frequency

RB3 Normal 10 divider (decimal point location)

### EEPROM MODE

False (0) True (1)

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RB0 - Increase EEPROM address

RB1 - Increase data value

RB2 - Decrease data value  
RB3 - Save to EEPROM

\*) Access to the EEPROM mode is enabled when the RB0 is true (1) and +5 V power is connected to the counter.

To Exit from the EEPROM mode, simply disconnect +5 V.

When the RB0 is false (0) and power is connected, the COUNTER MODE is started.

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## EEPROM ADDRESSES

; 00 = MFt1\_HigB = High Byte of RF offset1 (def. 0D) 9001.50 kHz = 0DBC36  
; 01 = MFt1\_MidB = Mid Byte of RF offset1 (def. BC)  
; 02 = MFt1\_LowB = Low Byte of RF offset1 (def. 36)  
; 03 = MFt2\_HigB = High Byte of RF offset2 (def. 0D) 8998.50 khz = 0DBB0A  
; 04 = MFt2\_MidB = Mid Byte of RF offset2 (def. BB)  
; 05 = MFt2\_LowB = Low Byte of RF offset2 (def. 0A)  
; 06 = Direct\_Freq = Direct frequency counter without sub or add = 00 h  
; Sub or Add function activated = 01...FFh (def. 00h)  
; 07 = EE\_Fine1 = Counter value for calibration 1 ==  $3^4/fx = 3\mu s$  (def. 15)  
; 08 = EE\_Fine2 = Counter value for calibration 1 ==  $4^4/fx = 4\mu s$  (def. 01)  
; 09 = 1x16\_Disp = LCD display type: 0 = 1x16 LCD, 1 = 2x20 LCD (def. 01)  
; 0A = Digits = Number of displayed digits: 0 = 7 digits, 1 = 6 (def. 1)  
; 0B...0Eh = (not in use)  
; 0F = Defaults = When set to 01...FFh then defaults are restored to EEPROM  
; on next power-on.

### Start-up of the counter

After the PIC16F84A is programmed and +5 V power is supplied to the Counter board, the default values are saved automatically into the EEPROM.

### Configuring Counter Parameters for IF Off-set:

If you are going to use your counter to measure the VFO frequency and use it for receiving frequency indication, you have to know the receiver IF-frequency (455kHz, 9.000 MHz etc).

With the SSB mode you must know the BFO frequency and use it as a Display offset. E.g. BFO frequency for LSB is 9001.5 MHz and USB 8998.5 MHz in super-heterodyne receiver.

With AM and FM mode use IF frequency as Display offset.

Next you have to convert this frequency to hexa format so that the first digit on right means 10 Hz decade e.g. 9000.00 kHz IF = 900000. Conversion to hexa = DBBA0 h. Next this hexa value is divided for two digit groups by starting from right:

**0D BB A0**

D = 0D = MFt1\_HigB

BB = MFt1\_MidB

A0 = MFt1\_LowB

Calculate MFt2 using similar method if needed.

### Parameter settings

1. Keep RB0 in state true (1) and connect +5 V to the counter.
2. Text "EEPROM MODE x.x" is displayed. (x.x = software version)
3. Text is shown at least 1.4 seconds until the RB0...RB3 have value False (0)
4. Next text "ADDR:00 DATA: FF" is displayed. This means EEPROM address 00h and its data value is FFh.
5. Press the RB1 (increment) or RB2 (decrement) to set calculated RF offset values.
6. When the data value is correct, press RB3 to save the value to EEPROM. When saved text "\*SAVED\*" is displayed and data is read again and displayed. This is a method to check the value immediately after saving.
7. Select next address 01h by RB0 and set the next data value. Press RB3 to save the value to EEPROM.
8. Repeat until all needed parameters have been set and saved (EEPROM addresses 01...0Ah).
9. Addresses 0B...0Eh are not in use. Exit the EEPROM MODE by disconnecting +5V.
10. Connect +5V back to the counter. Now the counter should display the measured frequency. (COUNTER MODE).
11. Calibrate the counter by comparing with another calibrated counter or by means of receiver (short wave reference station).

### EXAMPLE:

The minimum step is 1us using the combinations of EE\_fine1 & 2 based on the 4 MHz crystal. Relative effect of the one step is  $1\mu\text{s}/100000\text{ us} = 0.00001$ . A bit smaller value for T4 (see the mpasm code) is used than calculated according to formula in mpasm code to get +/- adjusting range for final correction by EE\_fine1 and EE\_fine2.

The correct calibration value is found by means of the combination of EE\_fine1&2 and comparing to reference frequency source. E.g. the freq. of calibrated reference source is 10.00000 MHz and counter shows 9.99980 MHz,

Then, the counting window is too short. Increase DELAY.  
See the table below.

However the most accurate calibration tuning is made in HW by adjusting one of the capacitor in the crystal circuit.

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07h	08h	
DELAY	EE_fine1	EE_fine2
1==	3 us	1== 4 us
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60 us	02h	09h
61 us	13h	01h
62 us	12h	02h
63 us	03h	09h
64 us	14h	01h
65 us	13h	02h
66 us	12h	03h
67 us	15h	----> 01h ---> Default
68 us	14h	02h
69 us	13h	03h
70 us	16h	01h
71 us	15h	02h
72 us	14h	03h
73 us	13h	04h
74 us	16h	02h
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12. Change the EEPROM address 07 & 08 values according to table above until the nearest value has been found. If the displayed frequency is below the reference, increase the delay and vice versa.

### How to use:

- RB1** to select either RF offset1 or RF offset2.
- RB2** to indicate direct frequency without add or sub the offsets.  
to move the decimal point one digit to right, if additional Divide by 10 is used in front of the counter input to extend the measuring range to VHF frequencies. The second decimal point is not displayed with 6 digit mode.
- RB3**
- RA2** to select either ADD or SUB the RF offset.

Thanks & Regards

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**For more details on this project please visit <http://www.foxdelta.com>**